



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01
Approval

TFT LCD Approval Specification

MODEL NO.: N150X2-L01
G33C0000M110

Customer : Toshiba

Approved by :

Note :

Liquid Crystal Display Division		
QRA Dept.	TDD I Dept.	PDD I Dept.
Approval	Approval	Approval
	李泓源 92.1.24	楊桂祥 92.1.22(代)



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

CONTENTS

REVISION HISTORY

GENERAL DESCRIPTION

1. ABSOLUTE MAXIMUM RATINGS

- 1.1 ABSOLUTE RATING OF ENVIRONMENT
- 1.2 ELECTRICAL ABSOLUTE RATINGS
- 1.3 MECHANICAL RATINGS
- 1.4 THE OTHERS

2. ELECTRICAL SPECIFICATIONS

- 2.1 TFT LCD MODULE
- 2.2 BACKLIGHT UNIT
- 2.3 MATERIAL LIST CONCERNING EMI REGULATIONS

3. INTERFACE SPECIFICATIONS

- 3.1 THE PIN ASSIGNMENT OF LVDS INTERFACE CONNECTOR
- 3.2 INPUT SIGNAL TIMING SPECIFICATIONS
- 3.3 COLOR DATA INPUT ASSIGNMENT
- 3.4 POWER UP/DOWN SEQUENCE

4. OPTICAL SPECIFICATIONS

- 4.1 TEST CONDITIONS
- 4.2 OPTICAL SPECIFICATIONS

5. MECHNICAL DRAWING

6. PRECAUTION

- 6.1 ASSEMBLY AND HANDLING PRECAUTION
- 6.2 SAFTY PRECAUTION

7. PACKING

- 7.1 PACKING SPECIFICATIONS
- 7.2 PACKING METHOD

8. DEFINITION OF SHIPPING LABEL ON MODULE

Attached 1, Drawing

Attached 2, TFT LCD Inspection Specification



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver 3.0	Dec. 30, '02			Final approval sheet is released.
Ver 3.1	Jan. 21, '03	9	2.2	<p>Revise connector PN to be</p> <p>Note (1) Connector PN.: BHTR-02VS-1 or equivalent</p> <p>Note (2) User's connector Part No.: SM02B-BHTS-B-TB or equivalent</p> <p>Remove Page 28~ Outgoing inspection Criteria</p>



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

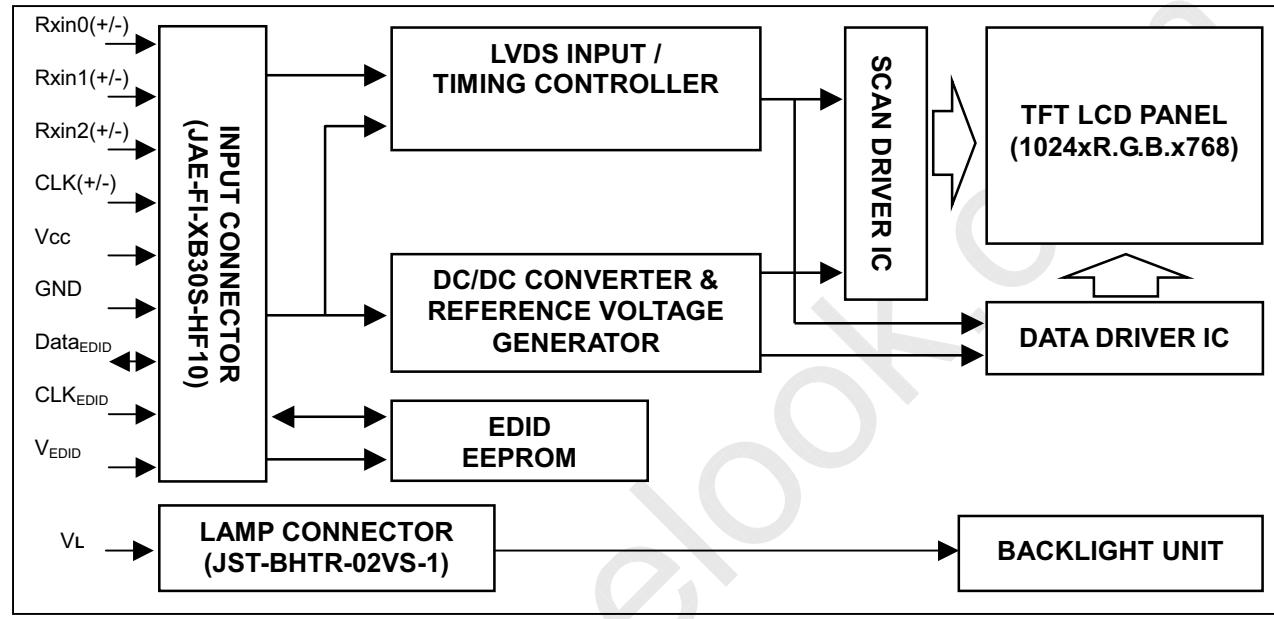
Approval

GENERAL DESCRIPTION

OVERVIEW

This product is a 15" TFT Liquid Crystal Display Module with a Backlight unit and 30 pins LVDS (Low Voltage Differential Signal) interface. This module supports 1024 x 768 XGA mode and can display 262,144 colors. The inverter module for Backlight is not built in.

BLOCK DIAGRAM



APPLICATION

-Note Book PC

GENERAL SPECIFICATIONS

Item	Specifications			Unit
Screen Size	15.0	Diagonal		inch
Bezel opening area	307.6(W)	x231.6(H)		mm
Effective display area	304.1(W)	x228.1(H)		mm
Pixel number	1024	x R.G.B	x768	pixel
Pixel pitch	0.297(H)	x 0.297(V)		mm
Pixel Arrangement	R.G.B Vertical Stripe			-
Display Color	6 bits	,	262,144	color
Transmissive mode	Normally white			-
Surface treatments	Hard coating (3H) and Anti-glare (Haze 25%)			-

MECHANICAL SPECIFICATIONS

ITEM	MIN.	TYP.	MAX.	Unit	Note
Module Size	Horizontal	315.5	315.8	mm	-
	Vertical	240.2	240.5	mm	-
	Depth	-	5.7	mm	(1)
Weight	480	490	500	g	-

Note 1: The maximum thickness of I/O connector area is 6.0mm.



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATING OF ENVIRONMENT

Item	Symbol	Min.	Max.	Unit	Note
Operating Ambient Temperature	T _{OP}	0	+50	°C	-
Operating Temperature for Panel	-	0	+60	°C	(2)
Storage Temperature	T _{STG}	-20	+60	°C	-
Operating Ambient Humidity	H _{OP}	20	90	%RH	(1)
Storage Humidity	H _{STG}	10	90	%RH	(1)
Air Pressure	-	70.0	-	kPa	Operation
Air Pressure	-	12.0	-	kPa	Non-Operation
Altitude	-	-	4572	m	Operation
Altitude	-	-	15240	m	Non-Operation

Note. (1) Wet bulb temperature should be 39°C Max, and no condensation of water.

(2) The surface temperature caused by self-heat radiation of cell itself is specified on this item.

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD Module

Parameter	Symbol	Values		Unit	Remarks
		Min.	Max.		
Power supply voltage	V _{CC}	-0.3	+4.0	V	
Logic input voltage	V _{IN}	-0.3	V _{CC} +0.3	V	Ta=0~50°C

(2) Backlight Unit

Parameter	Symbol	Values		Unit	Remarks
		Min.	Max.		
Lamp voltage	V _L	-	2.5K	V _{RMS}	Note (1)
Lamp current	I _L	1.8	7.0	mA _{RMS}	-
Lamp frequency	f _L	-	80	KHz	-

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.



Issued Date: Jan. 21, 2003

Model No. : N150X2-L01

Approval

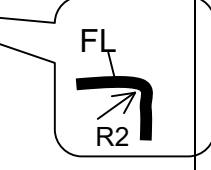
1.3 MECHANICAL RATINGS

LCD shall have no failure in the following reliability items.

Item	Test Conditions		Note
Mechanical Vibration	Frequency Range 5 – 500 Hz, 14.7m/s^2 (1.5G) constant, 0.5Hrs each axis (X, Y, Z direction)		Non Operation
	Frequency Range 5 – 500 Hz, 4.9m/s^2 (0.5G) constant, 0.5Hrs each axis (X, Y, Z direction)		Operation
Mechanical Shock	686m/s^2 (70G), Pulse width 11 ms, Half-Sine Wave, $\pm X, \pm Y, \pm Z$ direction, each 3 times.		Operation and Non Operation
	2548m/s^2 (260G), Pulse width 2mS, Half-Sine Wave, $\pm X, \pm Y, \pm Z$ direction, each 1 time		
Pressure Resistance	No Destruction with the force 196 N (20 kgf, 16 mm in diameter) to the display surface at the vertical direction		Non Operation Fig 1-3-1
	No Destruction with the force 294.2 N (30 kgf, 30 mm in diameter) to the back of the display surface at the vertical direction		Fig 1-3-2 Fig 1-3-3
Strength of FL Cable	Strength of rotation force	Cable: No disconnection of cable to the 5 trial of 360 degree rotation. See a bent state of cable.	Non Operation
		Connector: No disconnection of cable to 10 trial of 180 degree rotation. See a bent state of cable.	
	Lead pull test	Soldering portion: 14.7N (1.5kgf), 1min Connector: 14.7N (1.5kgf), 1 sec	
Connector tension test	Input connector: With 50 times of connector trial there must be no damage to the shape and functional.		Non Operation
	Back light connector: With 50 times of connector trial there must be no damage to the shape and functional.		
Assured torque value at side-mount part	245 mN·m (2.5 kgf·cm)		Non Operation
Rescrewed test	10 times under 245.0 mN·m (2.5 kgf·cm)		Non Operation
Tapping test	Test " Ripple " Phenomenon.		Operation

Definitions of failure for judgment shall be as follows:

- 1) Function of the module should be maintained.
- 2) Current consumption should be smaller than the specified value.
- 3) Appearance and display quality should not have distinguished degradation.
- 4) Luminance should be larger than the minimum value specified in optical specification.





Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

NOTE

(1) The compression condition of front side

(a) Compression point: 12 points (refer to Fig 1-3-1)

(b) Compression condition: Time 3 sec, Tool diameter: 16 mm in diameter (refer to Fig 1-3-3)

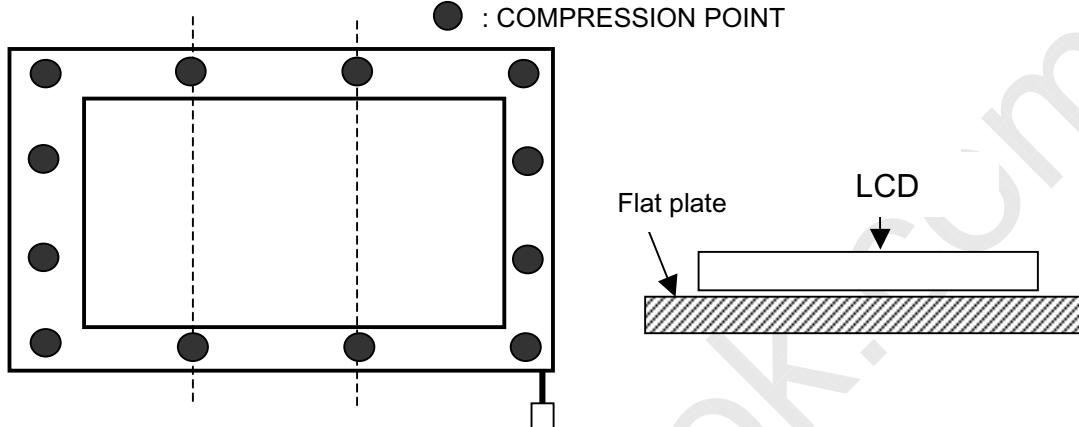


Fig 1-3-1

(2) The compression condition of rear side

(a) Compression point: 21 points (refer to Fig 1-3-2)

(b) Compression condition: Time 3 sec, Tool radius: 30 mm in diameter (refer to Fig 1-3-3)

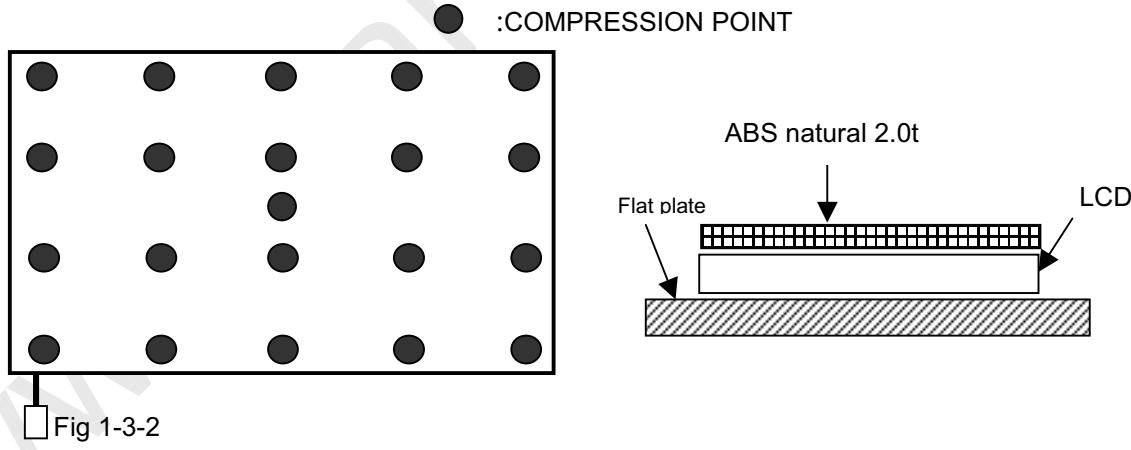


Fig 1-3-2

(3) Dimension of the compression jig

(a) compression jig for front side A = 16 mm in diameter
B = 16 mm in diameter

(b) compression jig for rear side A = 30 mm in diameter
B = 28 mm in diameter

(4) Recommend Torque is 1.3 – 1.5 kgf

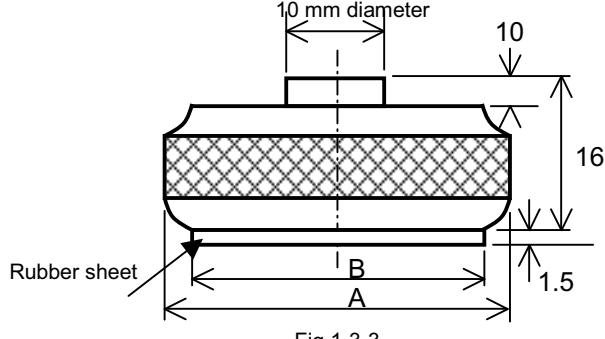


Fig 1-3-3



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

1.4 THE OTHERS

(1) Static electricity pressure resistance

Items	Testing conditions	Operation	Non Operation
Contact discharge	150pF, 330 ohm	±10 kV	±10 kV
Air discharge	150pF, 330 ohm	±20 kV	±20 kV

ESD Acceptance Definition:

Temporary performance degradation. Recovery by operator is acceptable. No hardware failure.

(2) Sound noise

There should be no uncomfortable noise.

Being used under whatever surrounds, when power on/off, the panel should not generate uncomfortable noise.

(3) Open / Short

No smoke, no fire at any open/ short test

(4) MTBF : 50000 Hr (except for backlight lamp)



Issued Date: Jan. 21, 2003

Model No. : N150X2-L01

Approval

2. ELECTRICAL SPECIFICATIONS

2.1 TFT LCD MODULE

MODULE						
Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	V _{CC}	3.0	3.3	3.6	V	(1)
"H" level LVDS signal input	V _{IH}	-	-	+100	mV	
"L" level LVDS signal input	V _{IL}	-100	-	-	mV	
Power Supply Current	I _{CC}	270	300	330	mA	(9)
		310	360	420	mA	
		470	540	600	mA	
Rush Current	I _{RUSH}	-	1.0	1.5	A	(2)
Ripple voltage	V _{RP}	-	50	100	mV	(1)
Terminating resistor	R _t	-	100	-	Ohm	

LCD Fuse name: Kamaya(FCC16-162ABTP)

2.2 BACKLIGHT UNIT

LAMP : Harison, MBVK2JB45YX309.5NCLFH/CS2

BACKLIGHT (1 Lamp)						
Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
Lamp Voltage	V _L	617	685	754	V _{RMS}	I _L =6.0mA
Lamp Current	I _L	2.0	6.0	6.5	mA	(3)
Startup Voltage	V _S	-	-	1150 (25°C)	V _{RMS}	(4)
		-	-	1500 (0 °C)	V _{RMS}	(4)
Operating Frequency	F _L	40	60	80	KHz	(5)
Power Consumption	P _L	-	4.11	-	W	(6), I _L =6.0mA
Lamp Life time	L _{BL}	10000	15000	-	Hrs	(7)

The connector information of Black light unit.

Pin	Symbol	Description	Remark
1	HV	Lamp power input	Pink
2	LV	Ground	White

Note (1) Connector PN.: BHTR-02VS-1 or equivalent

Note (2) User's connector Part No.: SM02B-BHTS-B-TB or equivalent

2.3 MATERIAL LIST CONCERNING EMI REGULATIONS

(1) EMI Regulations:

"N150X2-L01" which is assembled inside Toshiba's Satellite model should be met to the regulations as below:

CISPR: Pub.22 Class B

FCC : Part 15 Class B

VCCI : Class B

(2) Safety regulation (CMO TFT-LCD module only): UL 1950



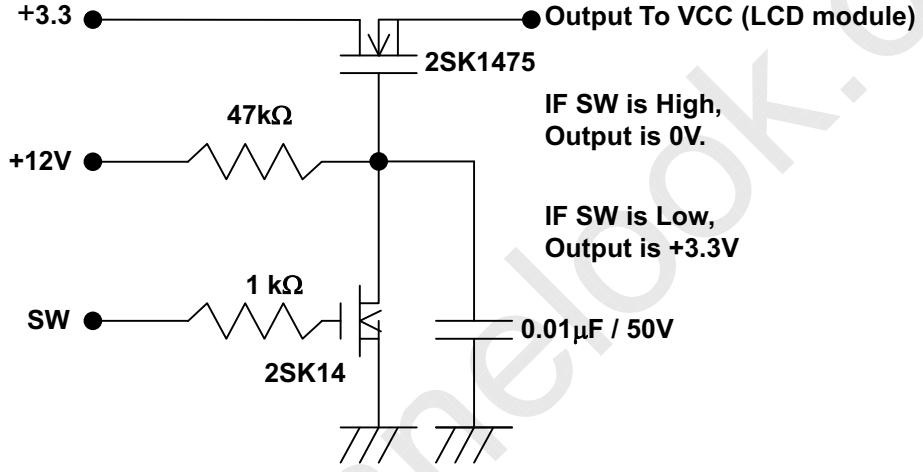
Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

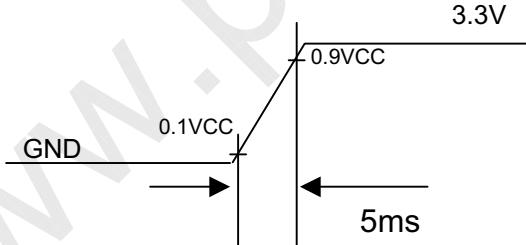
1. EMI Filter	Silk	Product Code	Rating	Maker
Bead	R407	BK1608LL241	240 Ohm/100MHz	TAIYO YU DEN Co.,JPN
Bead	LA1~LA10	BK32164M121	120 Ohm/100MHz	TAIYO YU DEN Co.,JPN
Bead	R406,424	BK1608LL121	120 Ohm / 100MHz	TAIYO YO DEN Co.,JPN
2. DC/DC Converter	Silk	Osc. Freq.		Maker
PWM IC	U9	Typ 1.2 MHz.		Linear Technology

Note (1) Operating Temp. range is 0 ~ 50 °C

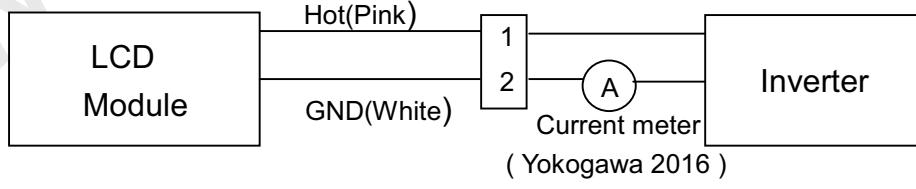
Note (2) Measurement Conditions is as below. Them maximum Vcc drop voltage that caused by rush current when switching-on should not be more than 0.5V.



VCC rising time is 5ms



Note (3) Lamp current is measured by utilizing a current meter for high frequency as shown below:



Note (4) The voltage shown above should be applied to the lamp for more than 1 second after startup.



Issued Date: Jan. 21, 2003

Model No. : N150X2-L01

Approval

Otherwise the lamp may not be turned on.

Note (5) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (6) $P_L = I_L \times V_L$.

Note (7) The lifetime (Hr) of a lamp can be defined as the time in which it continues to operate under the condition $T_a = 25 \pm 2^\circ C$ and $I_L = 2.0 \sim 6.5$ mAmps until one of the following event occurs :

- (1) When the brightness becomes 50% or lower than its original,
- (2) When the effective ignition length becomes 80% or lower than its original value.

(Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (8) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be designed with care so as not to produce too much current leakage from high-voltage output of the inverter. When designing or ordering the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occurs. When the above situation is confirmed, the module should be operated in the same manners as it is installed in your instrument.

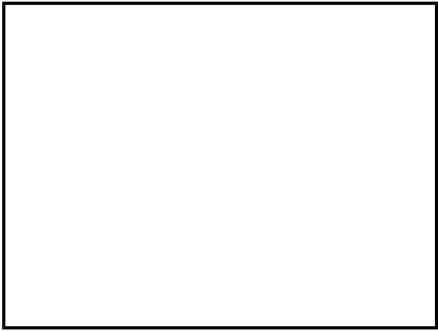
Note (9) The specified power supply current is under the conditions , $T_a = 25 \pm 2^\circ C$, $f_v = 60$ Hz, whereas a power dissipation check pattern below is displayed. In case of white pattern and black pattern, the maximum value is measured when $VCC=3.0V$, the typical value is measured when $VCC=3.3V$ and the minimum value is measured when $VCC=3.6V$. In case of maximum pattern, the maximum value is measured when $VCC=3.6V$, the typical value is measured when $VCC=3.3V$ and the minimum value is measured when $VCC=3.0V$.



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

a. White Pattern

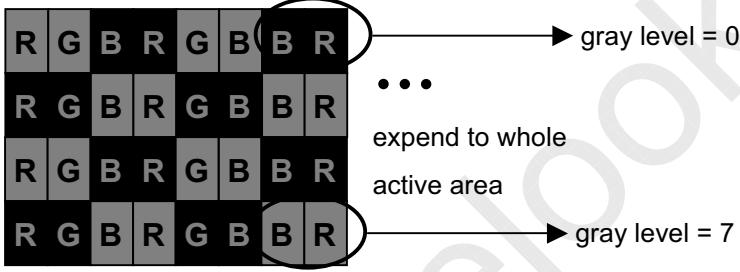


b. Black Pattern



Active Area

c. Maximum pattern (Zoom in)



• • • expend to whole active area



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

3. INTERFACE SPECIFICATIONS

3.1 THE PIN ASSIGNMENT OF LVDS INTERFACE CONNECTOR.

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	NC	Non-Connection		DDC 3.3V Power (reserved)
5	NC	Non-Connection		
6	NC	Non-Connection		DDC Clock (reserved)
7	NC	Non-Connection		DDC Data (reserved)
8	Rxin0-	LVDS Differential Data Input	Negative	R0~R5, G0
9	Rxin0+	LVDS Differential Data Input	Positive	-
10	Vss	Ground		
11	Rxin1-	LVDS Differential Data Input	Negative	G1~G5, B0, B1
12	Rxin1+	LVDS Differential Data Input	Positive	-
13	Vss	Ground		
14	Rxin2-	LVDS Differential Data Input	Negative	B2~B5, DE, Hsync, Vsync
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		
17	CLK-	LVDS Clock Data Input	Negative	LVDS Level Clock
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		
20	NC	Non-Connection		
21	NC	Non-Connection		
22	Vss	Ground		
23	NC	Non-Connection		
24	NC	Non-Connection		
25	Vss	Ground		
26	NC	Non-Connection		
27	NC	Non-Connection		
28	Vss	Ground		
29	NC	Non-Connection		
30	NC	Non-Connection		

Note (1) Connector Part No.: JAE-FI-XB30S-HF10 or equivalent.

Note (2) User's connector Part No: JAE-FI-X30M or equivalent.

Note (3) The first pixel is even.



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

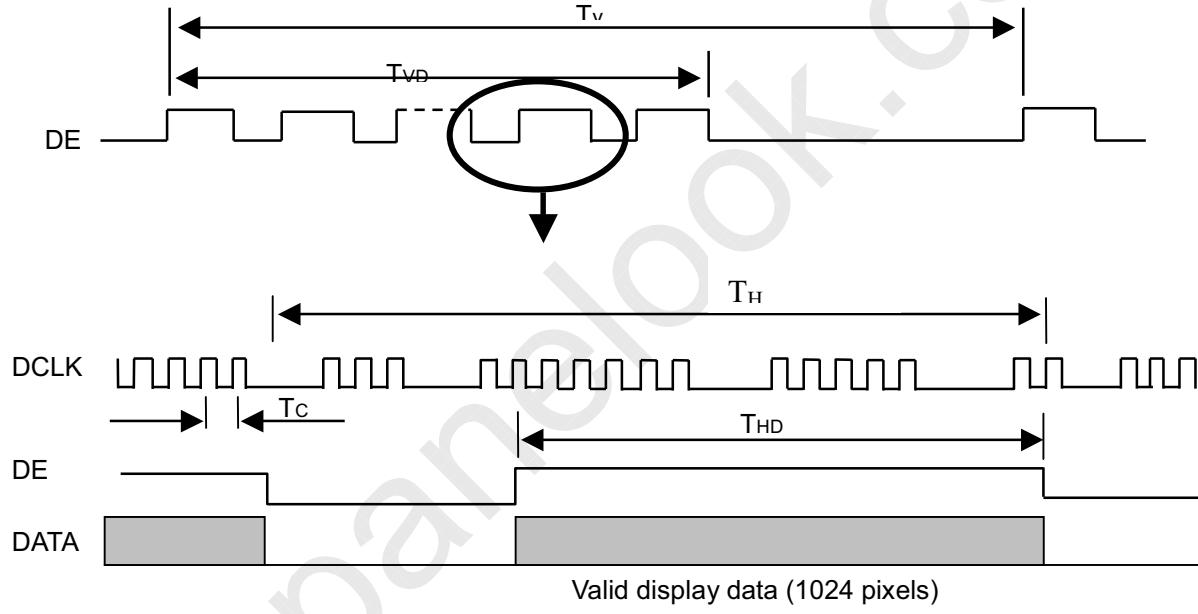
3.2 INPUT SIGNAL TIMING SPECIFICATIONS

The specifications of input signal timing are as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/T _c	50	65	68	MHz	-
Frame Frequency	Cycle	T _V	771	806	850	TH	-
Vertical Active Display Term	Display Period	T _{VD}	768	768	768	TH	-
One Line Scanning Time	Cycle	T _H	1200	1344	1500	T _c	-
Horizontal Active Display Term	Display Period	T _{HD}	1024	1024	1024	T _c	-

Note (1) The duration of DE signal must be longer than 1 clock period at every horizontal sync. period.

INPUT SIGNAL TIMING DIAGRAM





Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

3.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

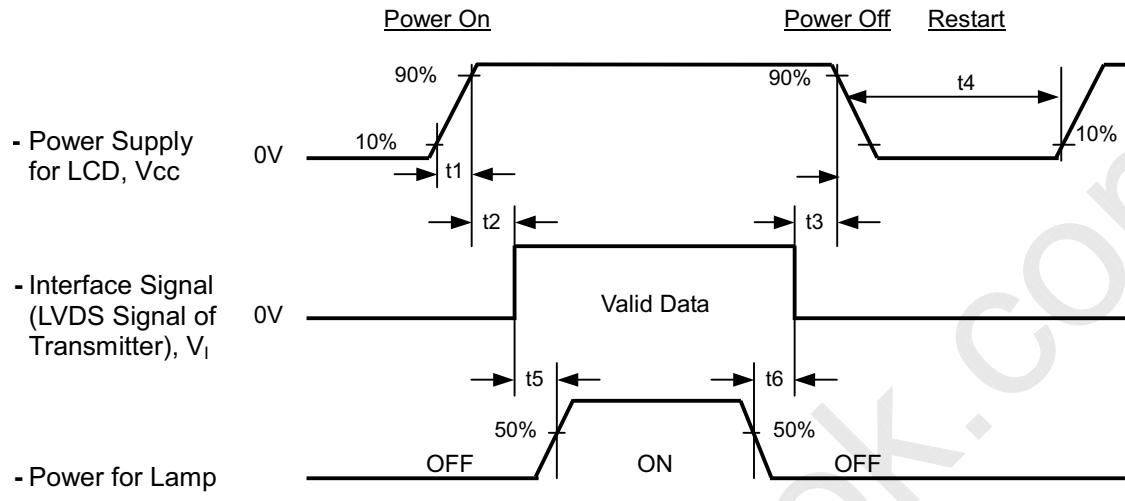
Color		Data Signal																			
		Red						Green						Blue							
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0		
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage



3.4 POWER UP/DOWN SEQUENCE & VCC DIP CONDITIONS

3.4.1 POWER UP/DOWN SEQUENCE



Timing Specifications:

$$0 < t_1 \leq 10 \text{ msec}$$

$$0 < t_2 \leq 50 \text{ msec}$$

$$0 < t_3 \leq 50 \text{ msec}$$

$$t_4 \geq 300 \text{ msec}$$

$$t_5 \geq 100 \text{ msec}$$

$$t_6 \geq 100 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD V_{cc} to 0 V.

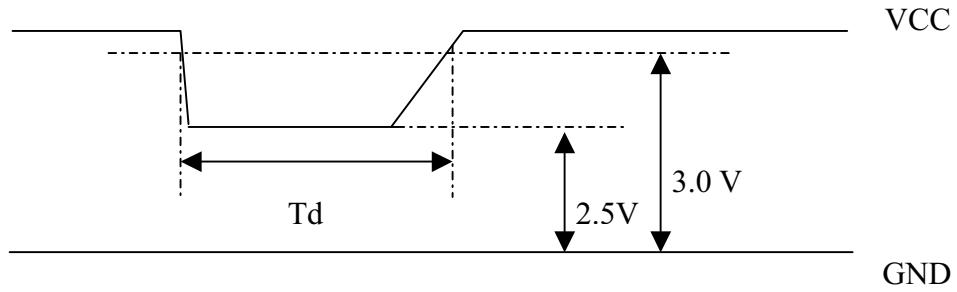
Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

3.4.2 VCC DIP CONDITIONS



(1) $2.5V \leq VCC < 3.0V$

$T_d \leq 20$ ms

(2) $VCC < 2.5V$

Vcc-Dip conditions also follow the power up/down conditions for supply voltage.



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

4. OPTICAL SPECIFICATIONS

4.1 TEST CONDITIONS

Ambient Temperature : $T_a = 25 \pm 2^\circ C$
 Ambient Humidity : $H_a 50 \pm 10\% RH$
 Supply Voltage : $V_{cc} = 3.3V$
 Input Signal : According to typical value in "Electrical Characteristics"
 FL Input Current : $I_{FL} = 6.0mArms$
 FL Driving Frequency : $f_{FL} = 50 kHz$
 FL Inverter : HBL-0237 (Tamura)

The measuring method is shown in 4.2. The following items are measured under stable conditions. The optical characteristics should be measured in a dark room (Screen luminance < 2-lx) or equivalent state with the methods shown in Note (6).

4.2 OPTICAL SPECIFICATIONS

Item	Symbol	Conditions	Specifications			Unit	Note	
			Min.	Typ.	Max.			
Contrast Ratio	CR_{AVE}	$\theta_X = \theta_Y = 0^\circ$ Viewing normal angle	200	250	-	-	(2),(6)	
Response Time	T_R		-	6	10	ms	(3)	
	T_F		-	17	25	ms		
Average luminance of white (5 points)	$Y_{L,AVE}$	$\theta_X = \theta_Y = 0^\circ$ Viewing normal angle	140	170	-	cd/m ²	$I_{FL}=6.0mArms^*$ Gray Scale Level=L63 (White) (4)	
Cross Modulation	D_{SHA}		-	-	1.0	%	(5)	
Luminance Uniformity Chromaticity	Red		0.569	0.599	0.629	-	(1), (6)	
			0.316	0.346	0.376	-		
	Green		0.299	0.329	0.359	-		
			0.495	0.525	0.555	-		
	Blue		0.121	0.151	0.181	-		
			0.097	0.127	0.157	-		
	White		0.306	0.336	0.366	-		
			0.314	0.344	0.374	-		
Viewing Angle	Hor.	Center $CR \geq 10$	40	45	-	deg.	(1), (6)	
			40	45	-			
			15	20	-			
			35	40	-			
	Ver.	Center $CR \geq 5$	50	55	-			
			50	55	-			
			25	30	-			
			40	45	-			
13 Points White Variation	δW	$\theta_X = \theta_Y = 0^\circ$ Viewing normal angle	1.0	1.3	1.6	-	(7)	
13 Points CR Variation	δC_R		-	2.0	2.5	-	(7)	
White Variation	dL		-	-	1.5	%/mm	(8)	



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

Item	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Gamma	63	$\theta_X = \theta_Y = 0^\circ$ Viewing normal angle	-	0.0%	-	%	(1) (6) at center of Viewing area center only
	60		-	0.2%	-		
	56		-	1.1%	-		
	52		-	2.6%	-		
	48		-	4.9%	-		
	44		-	8.0%	-		
	40		-	12.0%	-		
	36		-	16.8%	-		
	32		-	16.8%	-		
	28		-	29.2%	-		
	24		-	36.8%	-		
	20		-	45.4%	-		
	16		-	55.0%	-		
	12		-	65.6%	-		
	8		-	77.2%	-		
	4		-	89.8%	-		
	0		-	100.0%	-		

PS. Because of the color measurement discrepancy between TSB &CMO is ($\Delta Wx, \Delta Wy$)=>(0.01,0.009),

CMO internal spec of White is (Wx, Wy)Typ =>(0.326,0.335)

(Wx, Wy)Max=>(0.356,0.365)

(Wx, Wy)Min=>(0.296,0.305)

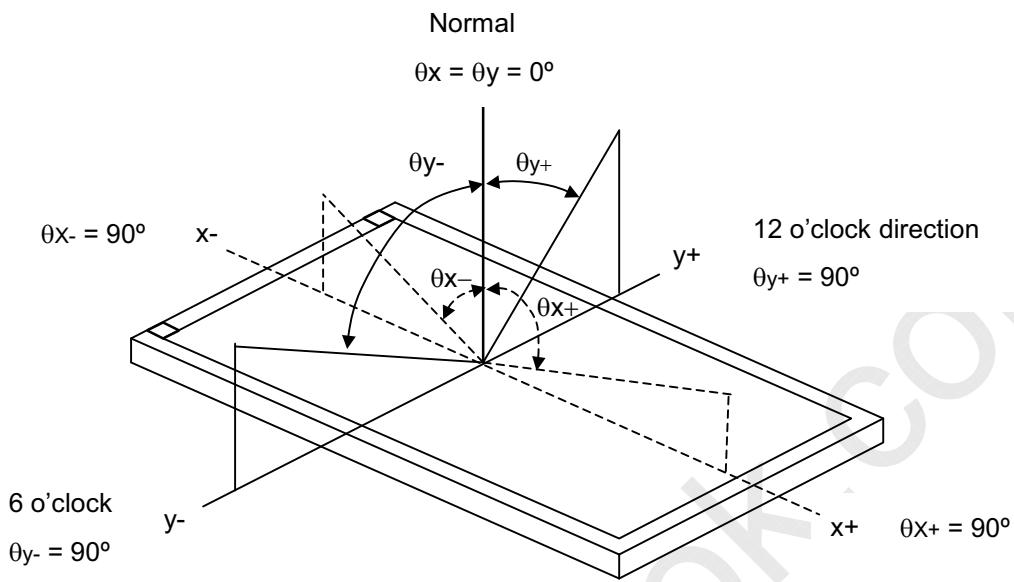


Issued Date: Jan. 21, 2003

Model No. : N150X2-L01

Approval

Note (1) Definition of Viewing Angle θ_x and θ_y :



Note (2) Definition of Contrast Ratio :

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

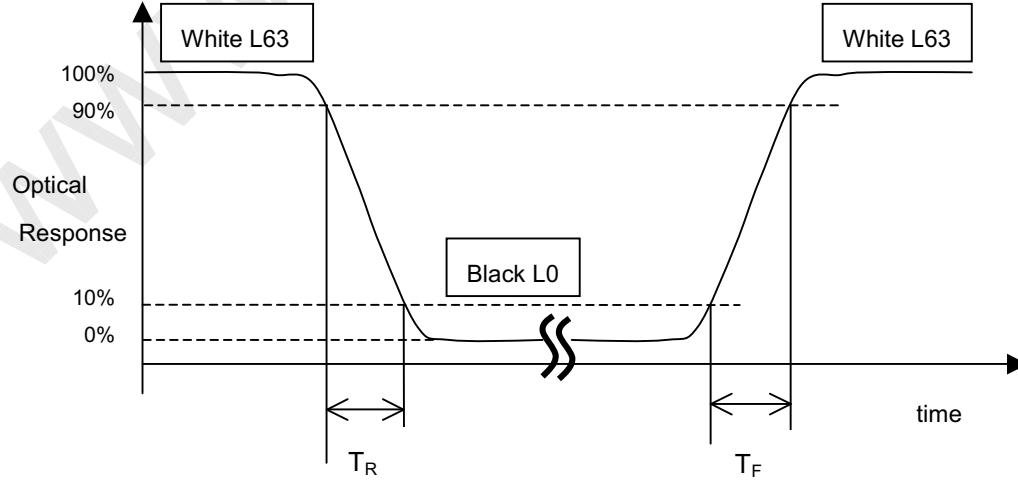
L_{63} : Luminance on the white raster (gray scale level L63)

L_0 : Luminance on the black raster (gray scale level L0)

$$CR_{AVE} = (CR(4)+CR(5)+CR(7)+CR(9)+CR(10)) / 5$$

$CR(X)$ is correspond to the Contrast Ratio of a point of X at Figure of Note (7).

Note (3) Definition of Response time :





Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

Note (4) Definition of Average Luminance of White :
measure the luminance of white at 5 points.
Average Luminance of White $Y_{L,AVE}$

$$Y_{L,AVE} = (Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}) / 5$$

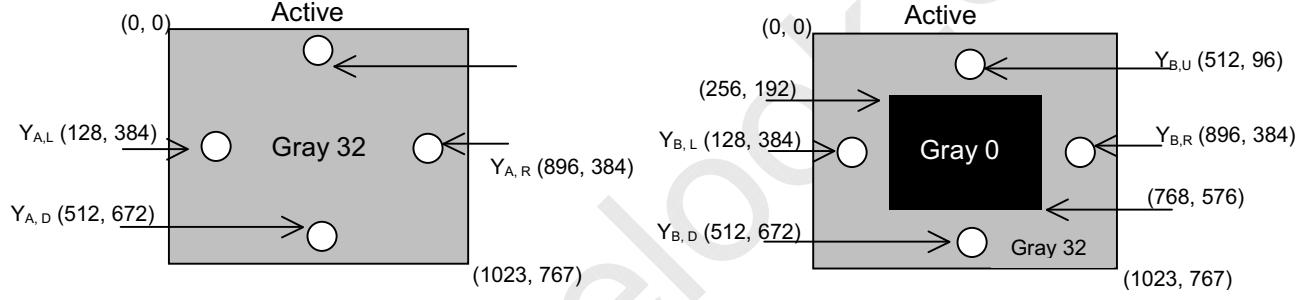
Y_{LX} is correspond to the Luminance of a point of X at Figure of Note (7).

Note (5) Definition of Cross Modulation (D_{SHA})

$$D_{SHA} = | Y_B - Y_A | / Y_A \times 100 (\%)$$

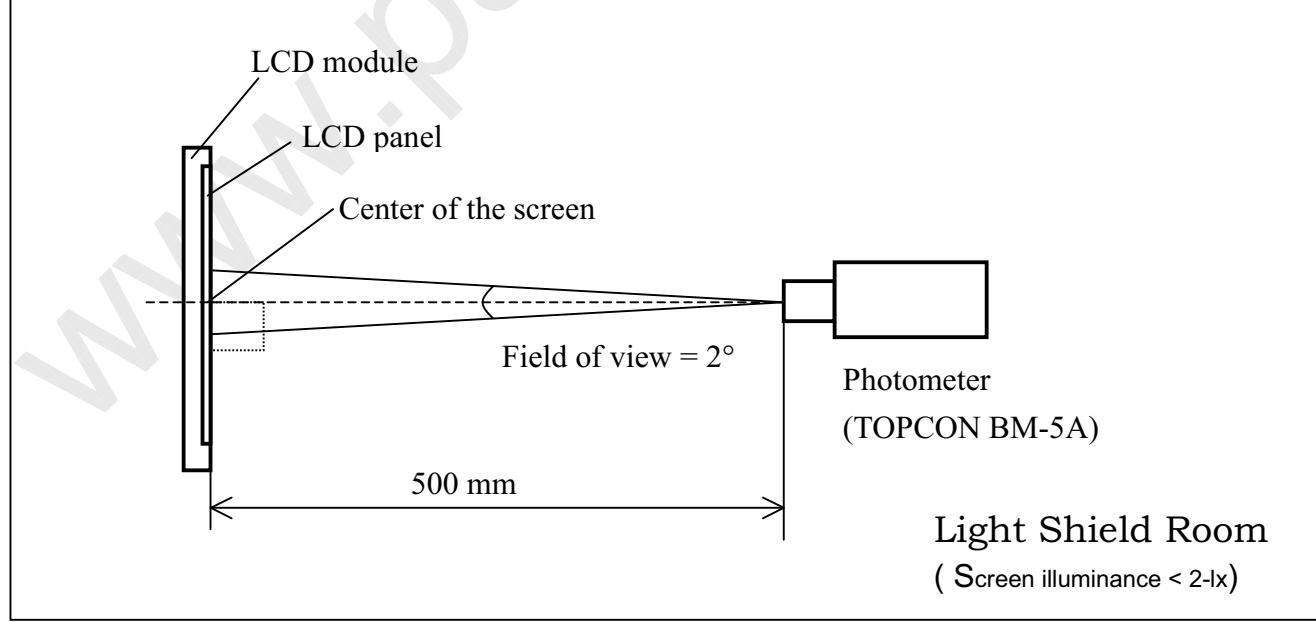
Where :

Y_A = Luminance of measured location without darkest gray pattern (cd/m^2)
 Y_B = Luminance of measured location with darkest gray pattern (cd/m^2)



Note (6) Measuring setup :

The measurement suppose to be executed after stabilized the panel at given temperature during 30min. in the case of abrupt temperature change. The measurement shall be executed 30 minutes after lighting at rating. The luminance of white should be typical luminance (Typical Condition $IL=6.0mA$). In order to stable the luminance, LCD shall not be gotten winds.





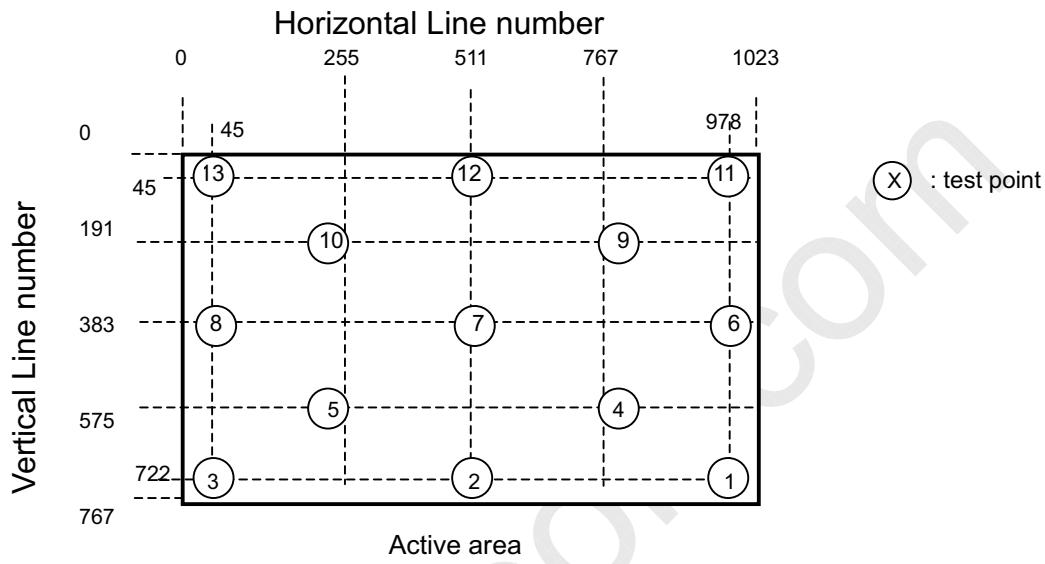
Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

Note (7) Definition of 13 points white variation δW , CR variation δC_R

$\delta W = \text{Maximum luminance of 13 points} / \text{Minimum luminance of 13 points}$

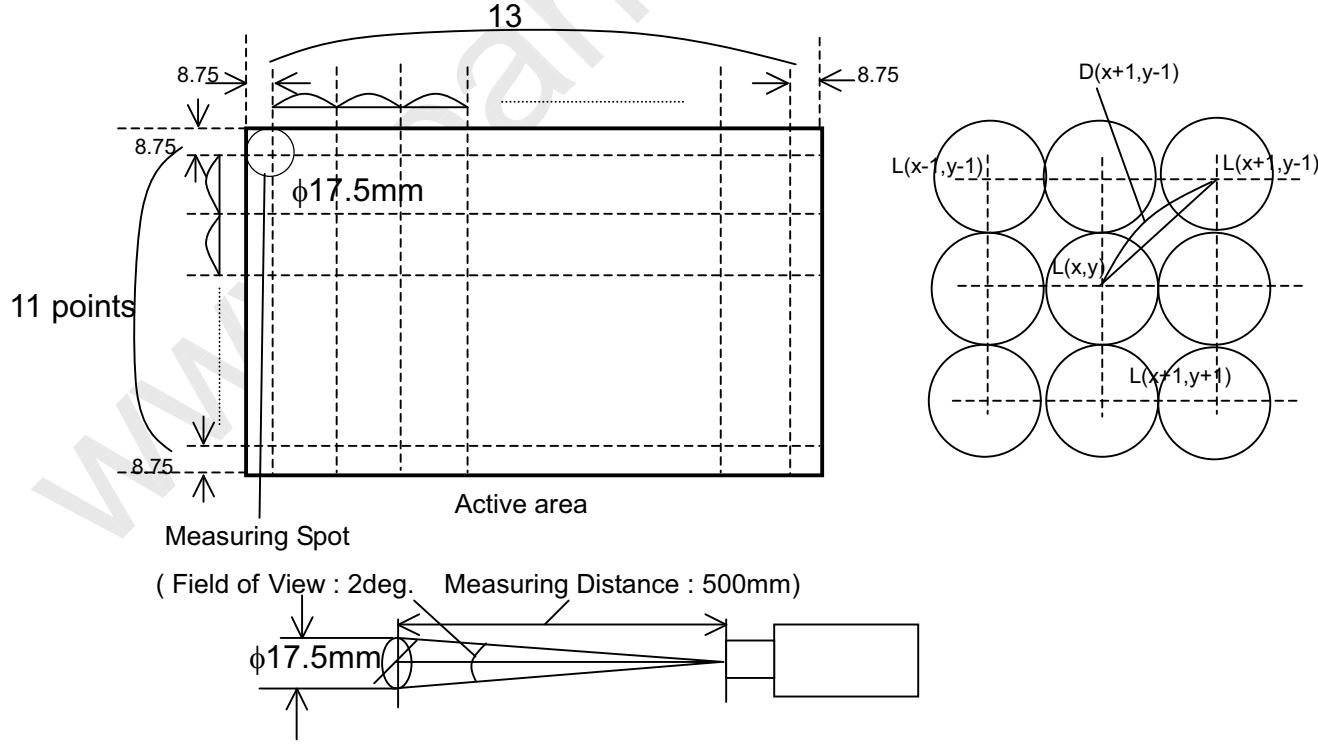
$\delta C_R = \text{Maximum CR 13 points} / \text{Minimum CR of 13 points}$



Note (8) Definition of White Variation dL : measure the luminance of white at 13×11 points.

$$dL = |L(x,y) - L(x+1, y+j)| / (L(x,y) \times D(x+1, y+j)) \times 100 \quad (\%/\text{mm})$$

where $2 \leq x \leq 12, 2 \leq y \leq 10, i = \pm 1, j = \pm 1$





Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

5. MECHANICAL DRAWING

Please refer to the attached drawings.

6. PRECAUTION

6. 1 ASSEMBLY AND HANDLING PRECAUTION

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latchup.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

6.2 SAFETY PRECAUTION

- (1) The startup voltage of backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

7. PACKAGING

7.1 PACKING SPECIFICATIONS

- (1) 10 LCD modules / 1 Box
- (2) Box dimensions : 422(L) X 337(W) X 345(H) mm
- (3) Weight : approximately 6.5Kg (10 modules per box)

7.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	Frequency Range: 5 – 50 Hz, Degree of acceleration 9.8 m/s ² (1G). Sweep rate 3 minutes Top & Bottom 60 minutes, Right & Left 15 minutes, Back & Forth 15 minutes	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation

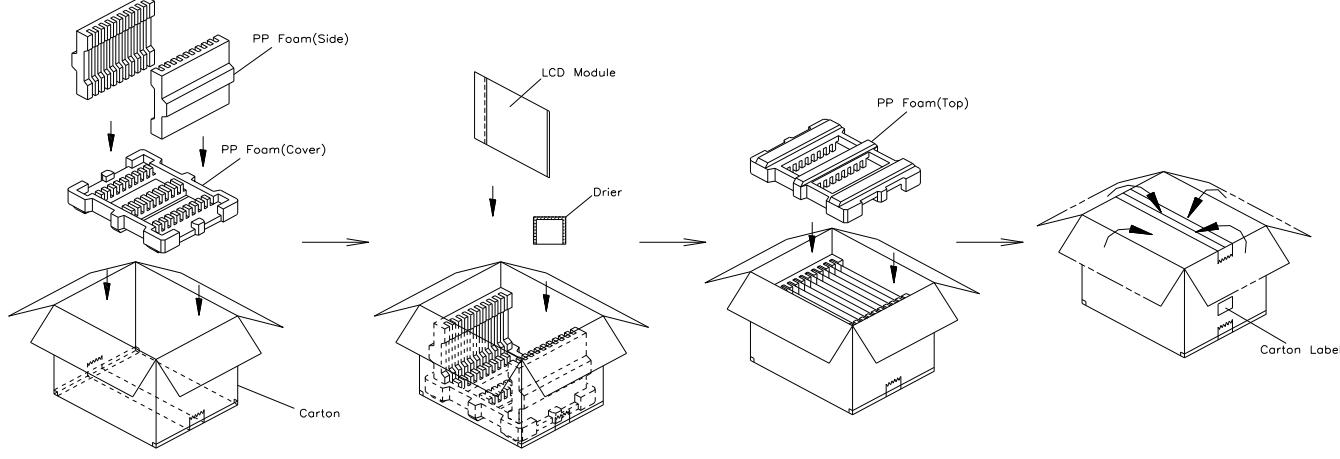
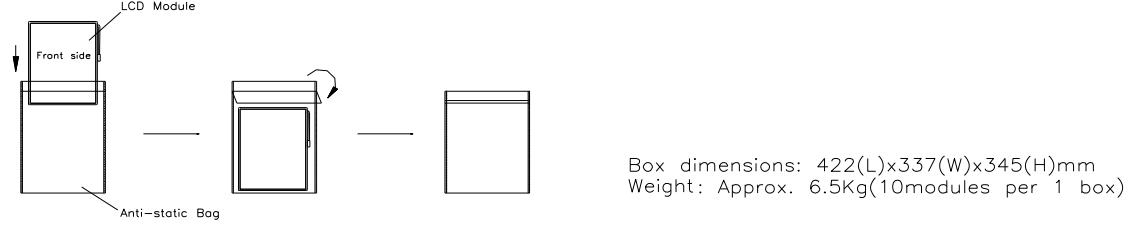


Figure. 7-1 Packing method



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

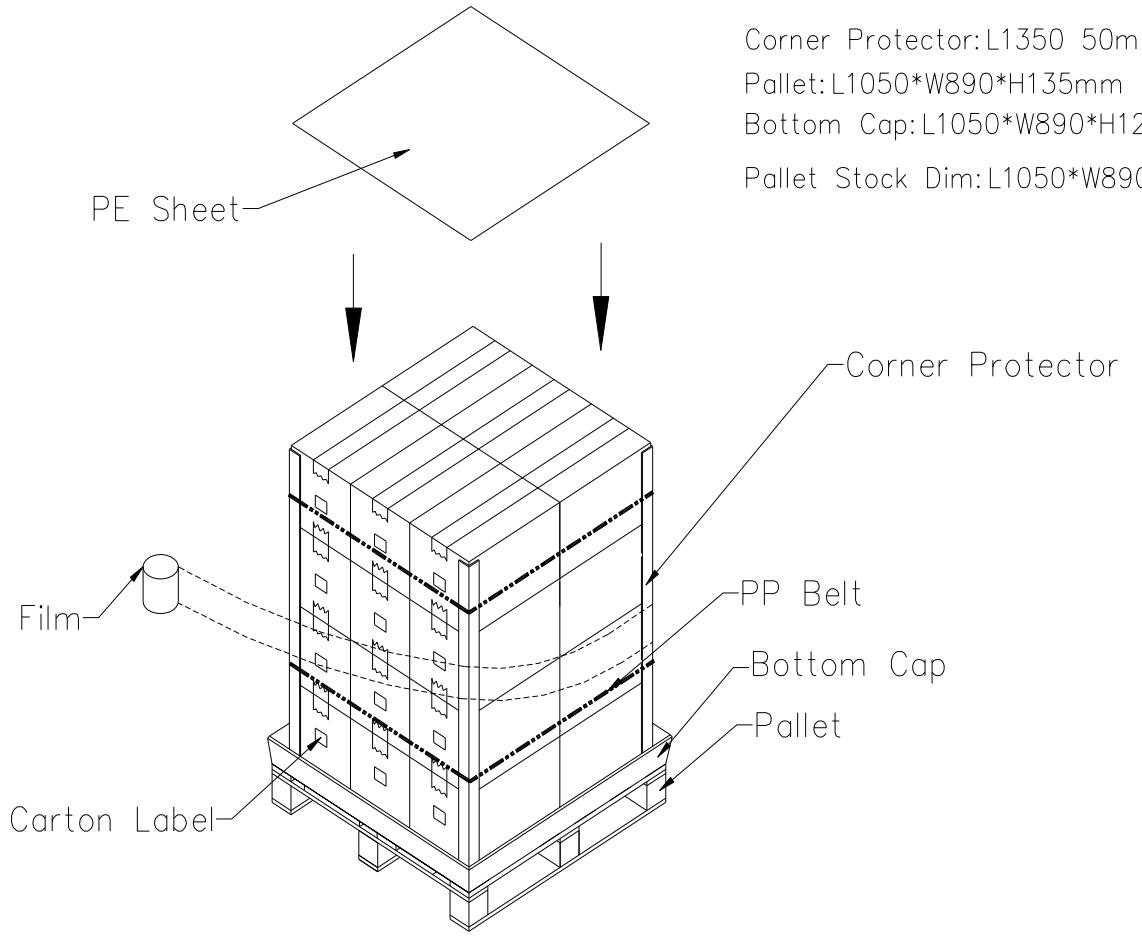


Figure. 7-2 Packing method



Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

Approval

8. DEFINITION OF SHIPPING LABEL ON MODULE

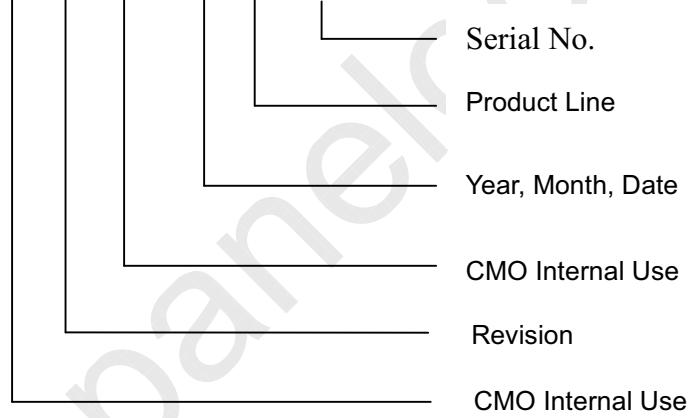
(1) CMO Label

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



70mm X 24mm

- (a) Model Name : N150X2-L01
- (b) Revision : Rev.XX, for example : C1, C2 ...etc.
- (c) Serial ID: XXXXXX XXX Y M D L N N N N



Serial ID include the information as list.

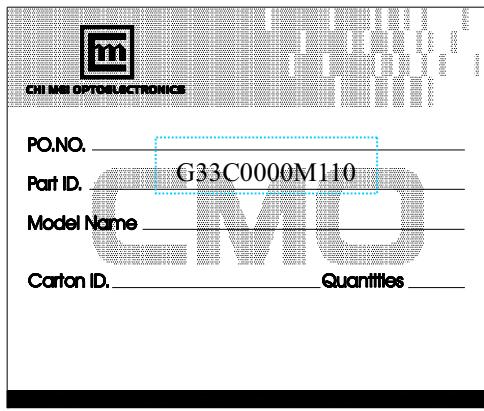
- (a) Manufactured Date: Year: 1~9, for 2001~2009
Month: 1~9, A~C, for Jan. ~ Dec.
Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U
- (b) Revision Code: cover all the change
- (c) Serial No.: Manufacturing sequence of product
- (d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.



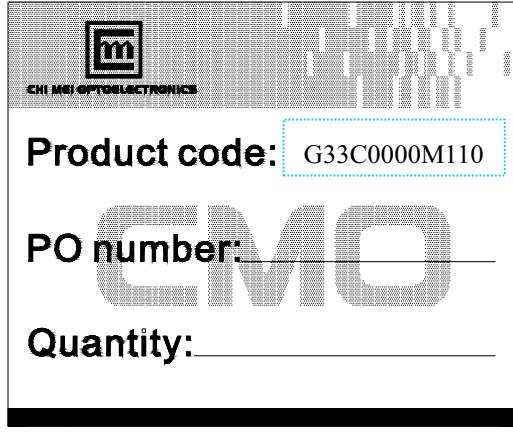
Issued Date: Jan. 21, 2003
Model No. : N150X2-L01

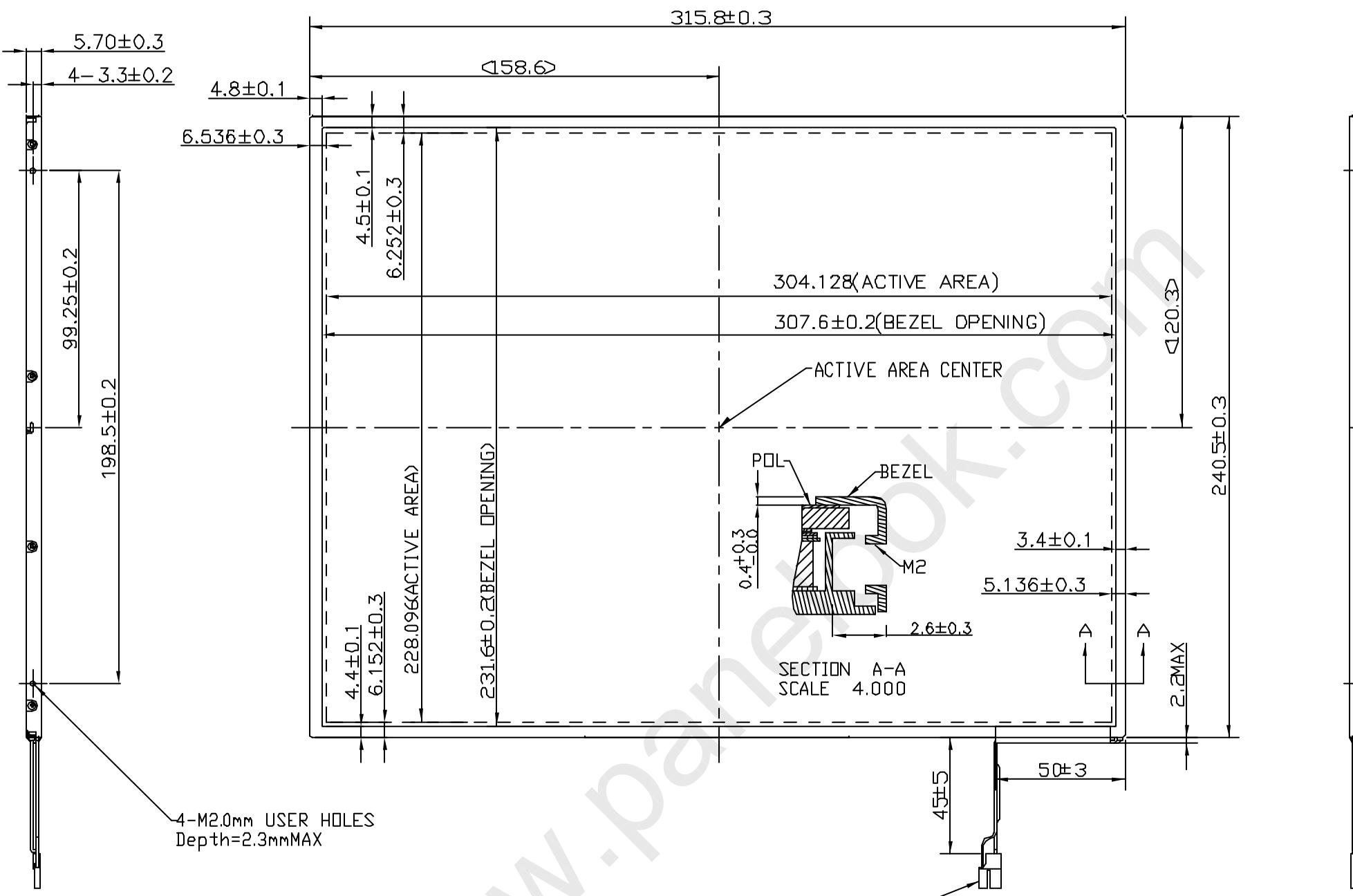
Approval

(2) Carton Label



(3) Pallet Label





NOTES:
1. SCREW TORQUE FOR MOUNTING SHALL NOT EXCEED 1.5kgf-cm.



CHI MEI
OPTOELECTRONICS CORP.

奇美電子股份有限公司

APPROVED:	DWG NO.: N15034102A		
CHECKED:	DATE: 12/26/2002		
DESIGNER: JOHNSON_LI	PART NO.:		
DRAWER: JOHNSON_LI	REV.: A	UNIT:	SCALE:
TITLE: OUTLINE N150X2	MM	1/2	1/2
"CHI MEI" COPYRIGHT 2002, ALL RIGHTS RESERVED, COPYING FORBIDDEN.			

MARK	DESCRIPTION	DATE	CHANGE BY	APPROVAL BY	ECN NO.

